The CORNELL ENGINEER

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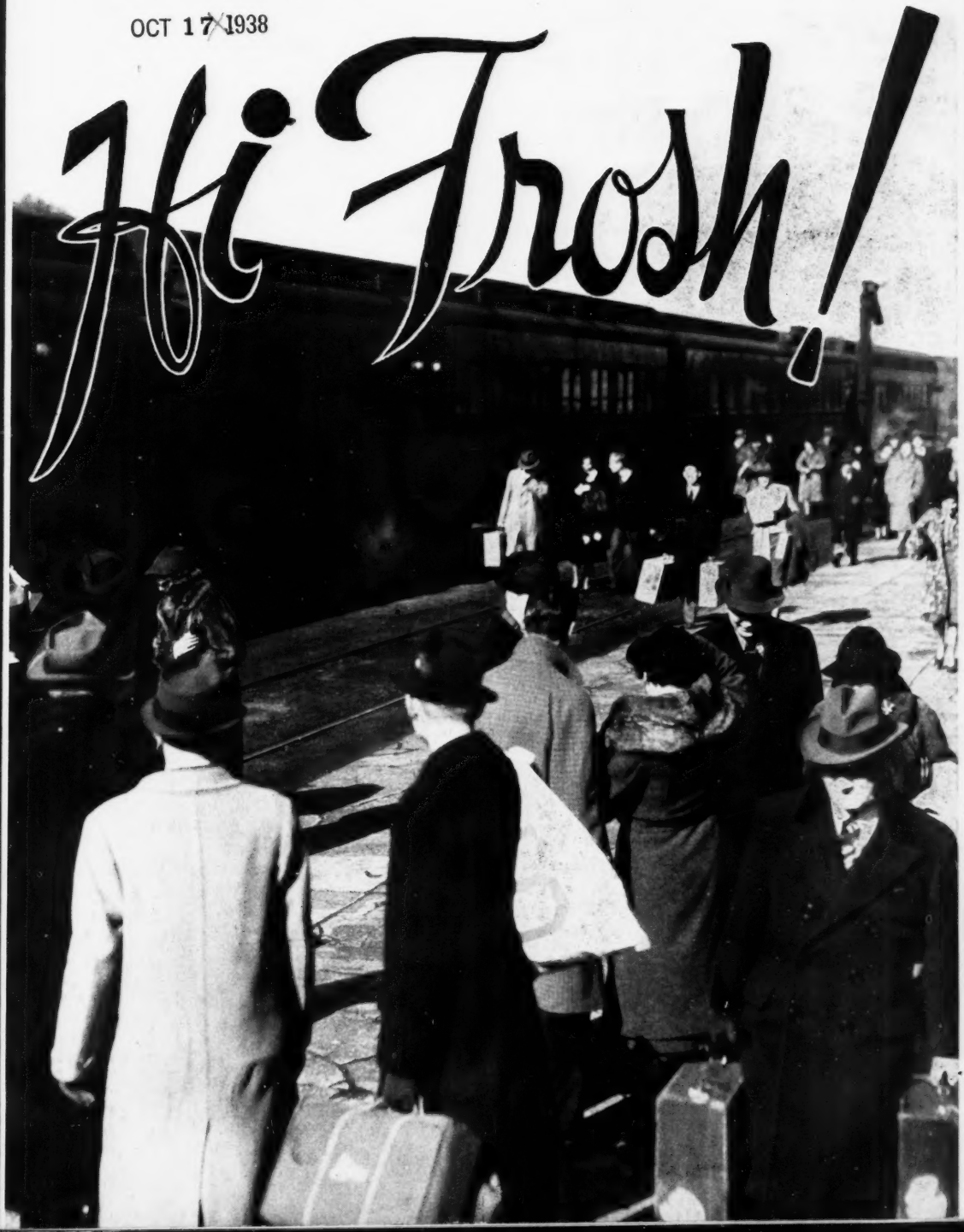

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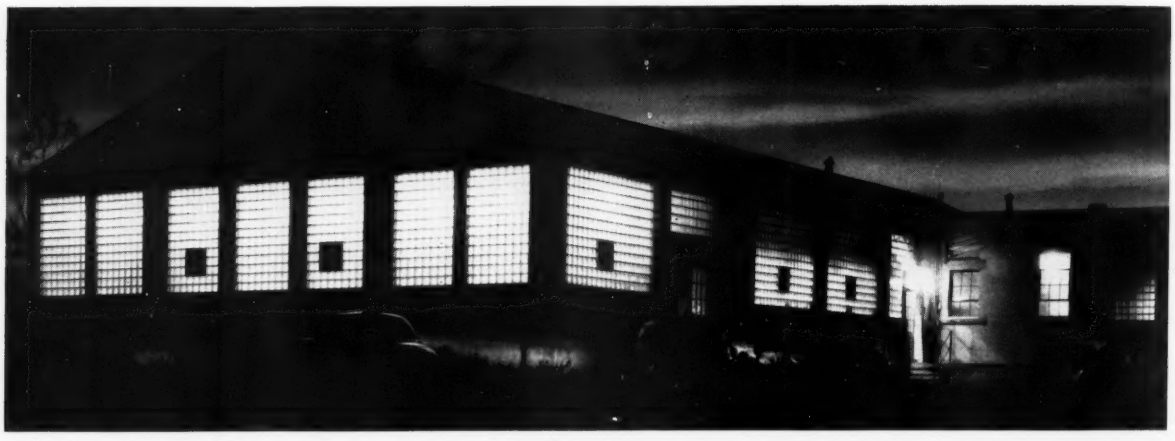

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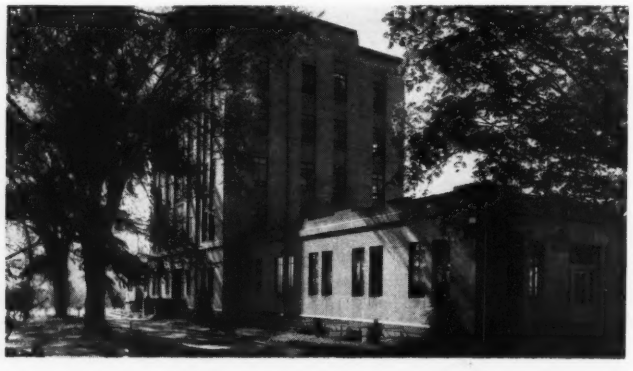

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THE CORNELL ENGINEER

VOLUME 4 NUMBER 1

for OCTOBER, 1938

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—*Courtesy Southern Power Journal*

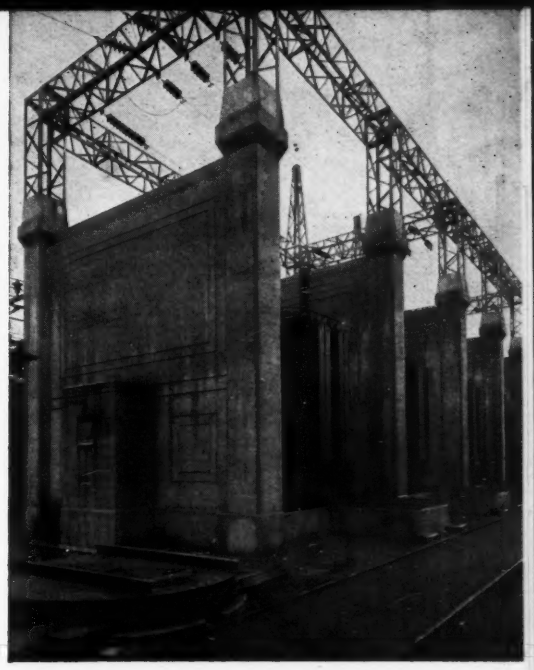
Power Plant at Logan, West Virginia of the Appalachian Electric Power Co.

Noteworthy Feature—First Boiler Designed For 1,000,000 Lbs. Steam.

MODERN POWER PLANTS

By EDWIN H. KRIEG, '22 M.E.

American Gas and Electric Service Corp.



—Courtesy Southern Power Journal
Transformers—Twin Branch Plant

A DISCUSSION of modern power plants should first present the picture of a power system as a whole, it being necessary to keep a proper perspective in dealing with the individual component hydro and steam plants.

AN INTERCONNECTED POWER SYSTEM

The operation of interconnected power systems is often confused with "superpower" which is meaningless, or else with long distance transmission which has meaning but is definitely limited.

Some years ago Chicago and Boston were tied together for a short time through intermediate power systems. The papers carried headlines such as a typical "Boston Lit by Chicago Power." This was not true as power was relayed or substituted along the way and no particular Chicago kilowatt ever reached Boston. The interesting part is that it was possible to operate such an extensive network in parallel.

Long distance transmission is a question of economics. Beyond a certain distance of about 100 miles it pays to haul coal in freight cars and burn it in a plant near the load center rather than transmit electricity over long distance power lines.[1]

An interconnected power system is entirely different from long distance transmission. In an interconnected system covering thousands of square miles, actual flow of power generated at one point to the point of use may perhaps be only 75 miles but by the substitution process, power placed at one point is and can actually be made available 1,000 miles away.

Interconnection means arranging a system to make a pooling of power-producing facilities possible. An interconnected system consists of a series of plants each normally capable of serving its own load area but ready, in case of emergency, to help out other parts of the system. This ability to insure continuity of service is the main difference between the interconnected system and the small isolated system. Of the many advantages of interconnected power systems the more important may be listed as follows:

a. It allows building plants in the proper locations. There are certain definite fundamental requirements to be considered when picking a location for a power plant. For example, about 500 lb. of cooling water is required for every one pound of coal burned and for a plant burning say a hundred tons of coal an hour, that means 50,000 tons of water an hour or 200,000 gal. per. min. and that is available only in relatively few locations.
b. Mutual help during emergency.
c. Allows for building of larger and more efficient generating plants and units.
d. Reduces the overall operating reserve required.
e. Allows the most efficient units on the system to be loaded. It may surprise you to know that at times we have the paradoxical condition where it is more economical to operate a 23,000 Btu (1.8 lb./kwh) plant than a 14,000 Btu (1.1 lb.) plant. It is sometimes better to run at partial than full load.
f. Allows for the staggering of installation of generating capacity.
g. In some cases interconnection permits efficient interchange of power between steam and hydro systems.
h. In some cases it allows taking advantage of natural diversity of load between systems.

Taking the system in West Virginia, Virginia and Kentucky, known as the Appalachian, as an example, while the Appalachian system is normally self-supporting, there are occasions when it may need help. For example, during an extremely dry season the hydro power may entirely disappear or, in cases of extreme emergencies when plants are put out of commission, the system may have to call on its interconnections for help. To take care of such conditions the Appalachian system is interconnected with other subsidiaries of the

(1) "Cost of Generation of Electric Energy," Phillip Sporn, Proceedings A.S.C.E., page 1925, December, 1937.

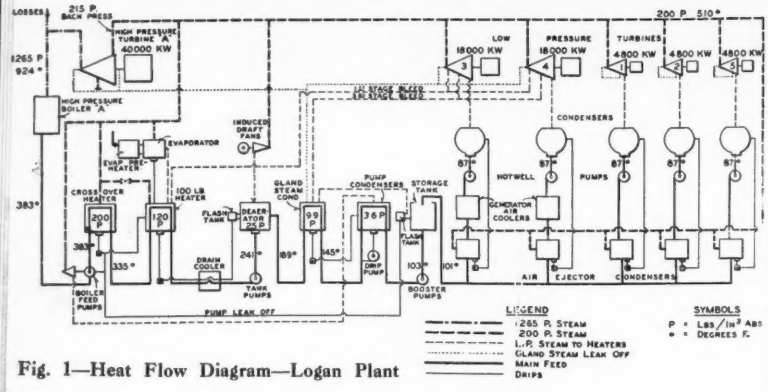


Fig. 1—Heat Flow Diagram—Logan Plant

American Gas and Electric Company through their ties with The Ohio Power Company. The total installed capacity of the American Gas and Electric Company interconnected system is roughly 1,250,000 kw. The main steam plants of the other susidiary companies are Twin Branch, Philo and Windsor.

Hydro-Electric Plants

The above discussion of an interconnected system then brings us to its component hydro and steam plants. Fundamentally, hydro power is a function of head and flow, or falling water. There can be a large flow with no head but it gives no power, such as the Mississippi River at New Orleans. The other extreme is high head but no flow which gives no power, as in the case of a rain drop. Both head and flow are needed but the combination cannot always be easily obtained and economically made available. To cite one case, that of the Kanawha River Marmet Dam, at times almost 14,000 kw are available during flood conditions; large flows are then available but no head so that no power is obtained. During the dry season of the year, head but no flow is available. *This is not firm power*. The average available capacity of 9,000 kw means nothing to an isolated system like this one as there is zero firm capacity. Such non-firm power must be backed up with steam plants that *will* furnish firm power.

The only reason this plant has any value at all is because it has the backing of steam plants and an interconnected system to provide firm power during either high or low water. The only reason it was built was because when hydro power is available it will save coal. The value of coal saved must balance the carrying cost on the large investment required in the hydro-electric plant, and dams cost a damsite—up to six times as much as a steam-electric plant.

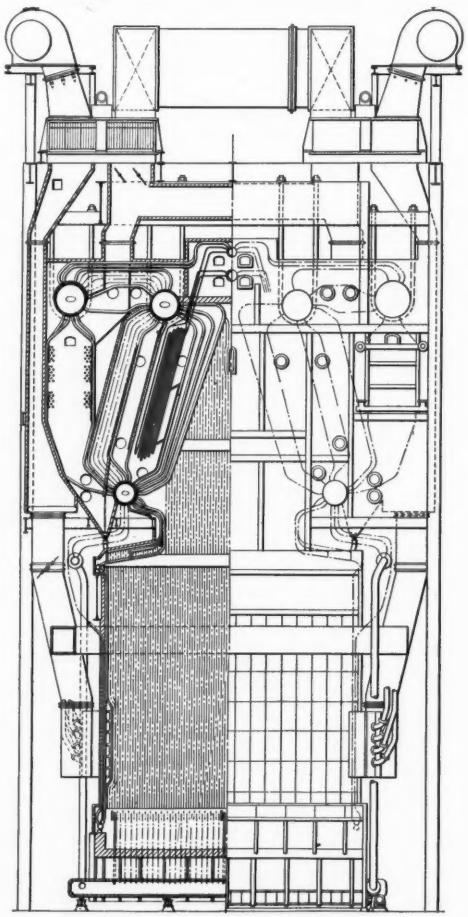
Steam-Electric Plants

The steam-electric plant is the backbone of the system for it must make up for the vagaries of rainfall and river flow. It is indeed a rare hydro plant that can offer firm power all year 'round. It means that the river has only been developed up to its minimum flow for no dam can provide storage for a year or two of drought.

Because everyone is so familiar with the straight condensing steam-electric plant, let us consider the more recent developments in steam-electric stations. The most outstanding modern feature is superposition, which is the rehabilitation or modernization of old plants by installing a high-pressure (800 to 1500 lbs.), high-temperature (850° to 950°F.) boiler and turbine. The turbine, instead of exhausting to a condenser, exhausts at about 200 lbs. pressure to the old turbines, which no longer receive steam from the old 200 lb. boilers which are usually removed. Boilers wear out more rapidly than do turbines. In addition, modern boilers afford far better efficiency and much less maintenance than the old boilers, whereas the old turbines are only some 6% less efficient than modern turbines with not much more maintenance.

Cycles

A typical superposition cycle is shown by Fig. 1, that of the Logan Plant. The Windsor cycle includes two 1250 lb. pressure boilers supplying a 60,000 kw,



—Courtesy Power Plant Engineering

Fig. 2.—Steam Generating Unit for Logan. Designed for 1,000,000 Lb. of Steam Per Hour at 1325 Lb. Per Sq. In. and 925°F. at Superheater Outlet.

1250 lb. pressure turbine generator that exhausts to three 230 lb. pressure turbines having a combined rating of 90,000 kw. In both cycles the net station capacity was increased by keeping motor-driven auxiliaries to a minimum so that not so large a proportion of the station generating capacity is diverted to station auxiliary drives. The amount of steam that can be used for driving station auxiliaries is, of course, limited by the quantity of feedwater available for absorbing the heat in the auxiliary turbine exhaust steam. At Twin Branch, the new 375 lb. pressure turbine is so well equipped with extraction or bleed openings (which is not the case in the 20 year-old Logan and Windsor low-pressure turbines), that it proved uneconomical to exhaust the feed pump turbines to the feedwater cycle. They will, therefore, be provided with their own condensers supplied with river water.

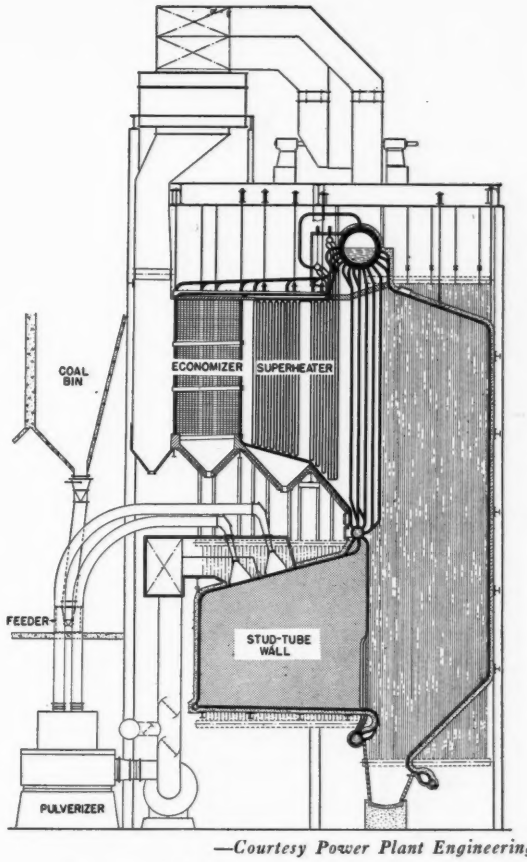
Whereas the Logan and Windsor cycles are straight regenerative without reheat, the Twin Branch cycle is seen to be regenerative-reheat to avoid excessive moisture in the low-pressure turbine. This would not only cause high maintenance resulting from blade erosion, but the moisture exerts a large braking effect which decreases the turbine efficiency. These problems are eliminated by reheating the steam between the two turbines.

Boilers

An example of modern boilers is shown by Fig. 2, showing the Logan boiler; the outstanding features are:

1. The first boiler installed for a rating of 1,000,000 pounds of steam per hour.
2. The first boiler purchased for a superheater outlet temperature of 925°F.
3. Superheater temperature may be regulated by a bypass with a tolerance of plus or minus 10°F.
4. It has six drums and the water walls have tubes tangent to each other.
5. The burners are set in a so-called tangential arrangement that produce a whirling flame in the furnace.
6. It has a dry bottom so as to increase the load range over which it may operate, this being 5:1. This load range could not be obtained with a wet bottom as with low ratings the slag would not be molten and could not be tapped. A dry bottom also makes it possible to handle coals with a wide range of fusion temperatures from 2300°F. to 3000°F.

At Windsor there are two boilers, one supplied by the Combustion Engineering Co. and the other by the Foster Wheeler Co. The former features the superheat control burner located high up in the front furnace wall. This will give a degree of superheat control over a wider range than would be possible with damper bypassing alone. The latter or Foster Wheeler boiler has the first split furnace that has been built. Each half of the split furnace is independently fired, one-half being equipped with a radiant-type superheater in the wall section. The net effect is to give maximum ease in control of superheat over the range and limits desired. This also makes possible the use of dry bottom design even under the rigid operating specifications of



—Courtesy Power Plant Engineering

Fig. 3—Radial Type Boiler and Furnace Installation.

coal fusion temperatures running from 1900° to 2700°F. During starting, the half of the furnace having the radiant-type superheater is not fired, thus protecting it against overheating.

Fig. 3 shows a radiant-type boiler somewhat similar to the one that is being developed for Twin Branch. This boiler, more than the others, uses radiant heat absorption in order to simplify the hydraulic circuit because of the necessity of keeping resistance of the hydraulic circuit to a minimum. The feature of this boiler is the drum pressure of 2500 lbs. and the superheater outlet pressure of 2400 lbs. at 940°F.

Turbines

At Logan is an 11-stage, 40,000 kw. turbine, which, when it was purchased, was the largest 3600 rpm unit that ever had been built. The generator was the first hydrogen-cooled unit placed on order. In addition, instead of using tubular hydrogen coolers, direct cooling of the iron and windings in the stator was accomplished by water pads which absorb most of the heat by direct conduction instead of the usual convection. The rotor is cooled by circulating hydrogen gas which gives up heat to certain of the stator water pads which are equipped with fins. The use of hydro-

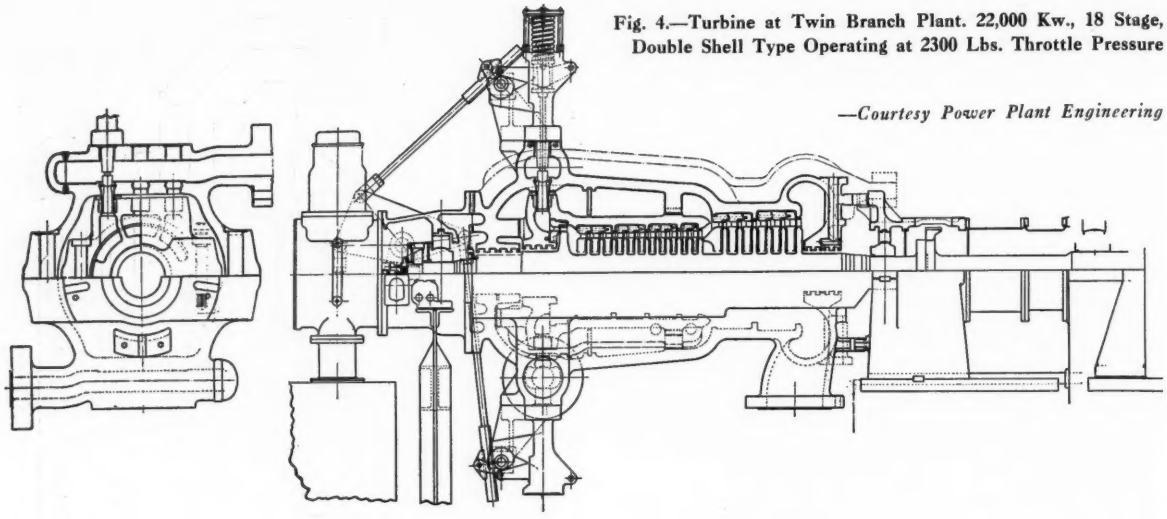


Fig. 4.—Turbine at Twin Branch Plant. 22,000 Kw., 18 Stage, Double Shell Type Operating at 2300 Lbs. Throttle Pressure

—Courtesy Power Plant Engineering

gen cooling in this generator reduces the heat and windage losses by some 450 kw less than in a convectional air cooled generator of the same rating.

The 60,000 kw Windsor turbine is of a different construction in that the control valves are mounted directly on the turbine instead of in a separate valve chest underneath the turbine. This is the largest 3600 rpm machine that has ever been built. The pedestal construction for the governor bearing is also different from the Logan machine, employing a pedestal block instead of an eye beam.

Fig. 4 shows a cross-section of the 22,000 kw Twin Branch turbine that will operate with 2300 lbs. throttle pressure. It will be an 18-stage double-shell machine with control valves mounted on the casing, otherwise quite similar to Windsor, except that the governor bearing will have the eye beam type of support. These three turbines were made by the General Electric Company.

General

Among the objectives of modern power plant design are maximum fuel efficiency consonant with minimum investment to obtain maximum financial efficiency. To secure the best fuel efficiency, advantage is taken of the advances in metallurgy that permit the use of steam temperatures up to 950°F. At the present time, metallurgy does not offer materials capable of extending this limit. Perhaps greater boiler efficiencies could be obtained but when there is sulphur in the coal a too-high boiler efficiency can not be justified because of the extensive corrosion that results when the stack gases containing sulphur dioxide and sulphur trioxide are cooled nearly to their dewpoint. Fuel efficiency is also obtained by using regenerative cycle and even reheating where it proves economical.

An attempt has been made to minimize capital investment by superposition which does not require additions to the existing circulating water system, coal handling system, condensers, and many other plant facilities. By superposition it is possible to utilize the existing turbines and at the same time replace the old boilers which have had a greater degree of wear and tear and obsolescence due to improved efficiencies obtainable by new boilers. However, superposition has definite limits.*

Briefly, one of the important limitations of superposition is the consideration that must be given against installing too much superposed capacity in any system. A superposed station is really a large cross-compounded unit and as such it forms a large proportion of the system capacity. Other limitations are the expediency with which the superposed turbine may be bypassed, in case of trouble, so as not to lose the low-pressure turbines which it serves. It is also necessary to take precautions to prevent motorizing of the unit which would overheat the turbine in a very short time causing a great deal of damage. This may be done with some degree of safety by installing reverse power protection on the generator.

After a system has installed as much superposed capacity in its old plants as can be justified, the present trend is toward installing a 3600 rpm unit driven by a turbine having a pressure of from 800 lbs. to 1250 lbs. and 900° to 925°F. Such a condensing unit can be obtained at present in sizes up to about 45,000 kw as a maximum, which is set by the amount of area that it is now possible to obtain in a 3600 rpm machine in the last stage wheel. This area is limited by the blade lengths that can be obtained with present available steels. Above this size, 1800 rpm units must be used.

*"Superposition"—E. H. Krieg, page 562, Mechanical Engineering September, 1936.

Greetings!

CLASS OF 1942

It is a pleasure to extend to you on behalf of the College of Engineering a cordial welcome.

Yours is the 71st class to study engineering at Cornell. More than 15,000 engineers from Cornell are practicing their profession all over the world. The reputation for the institution which they have built up is a heritage which you now begin to enjoy. With it, however, goes a responsibility to be the kind of engineers others have been before you, the kind of which Cornell is justly proud.

It is important for you to remember that all of your acts henceforward will reflect in some manner upon Cornell. It is your duty, therefore, to guard her reputation jealously through the mastery of your profession.

We wish you every success in the years before you. The staff will give you every reasonable assistance to advance you in your professional career. Remember that your future success is, after all, a day-to-day process. Each day's work well done is a sure step forward on your path to success.

Sincerely yours,

S. C. HOLLISTER

Sept. 21, 1938.

CORNELL SOCIETY of ENGINEERS

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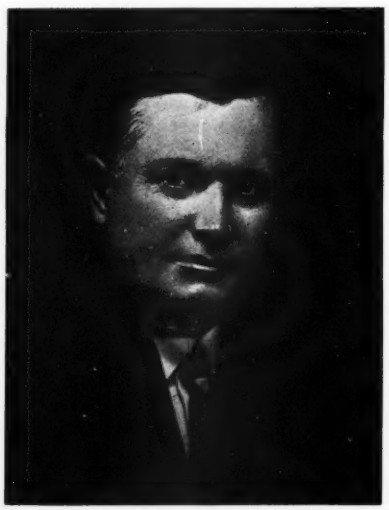
"The objects of this Society are to promote the Welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Column

September 15, 1938

Fellow Engineers:

One of the duties of the president of your society is to prepare a letter for each issue of THE CORNELL ENGINEER. It is the purpose of these monthly letters to acquaint you with the activities of our society in furthering the standing of Cornell and the Engineering College in particular, and to bespeak your interest in the fullest attainment thereof.



WALKER L. CISLER '22, President

First, on behalf of the officers and members of the Executive Committee, I wish to extend to you our greetings. Unfortunately, during the course of the year, the opportunity is not given to meet with all of you, but it is hoped you will communicate with us on any matters on which we can be of service.

With the establishment on July 1 of the School of Chemical Engineering as the fourth unit of the College of Engineering, a distinct step forward was taken in the development of the curricula in the College. We invite the faculty, the students, and the alumni to join with us in our activities.

At this date of writing, there are about eight hundred members of the society and it is expected that this number will shortly be materially increased. George N. Brown, '08, is Chairman of the Membership Committee, and we ask your help in assisting him in his work. His address is 55 Liberty Street, New York, N. Y.

Membership in the society carries with it a subscription to THE CORNELL ENGINEER, thus assisting in building up the circulation of the publication and bringing to the members a paper worthy of their support. THE CORNELL ENGINEER has been improved remarkably lately and we confidently expect that this year it will continue to improve under the guidance and enthusiasm of the new staff.

At a recent meeting of the Executive Committee there was established for the present year the First Annual Award of the society in the form of book awards to two sophomores in each of the four schools of the Engineering College, and a $100 award to be divided among the five senior members of the Editorial Board of THE CORNELL ENGINEER. It is hoped that with increased membership in the society these awards can be continued and perhaps expanded.

For several years past, efforts have been directed toward the formation of regional sections of the society. It is expected that the first such section will be formed in Pittsburgh this Fall. Professor John R. Bangs, Jr., '21, is the chairman of the committee in charge of this activity. He can be addressed at the College of Engineering.

Finally, a few words of greeting to the new students. As one of the many thousands who have attended the College of Engineering, I want to congratulate you on your selection of Cornell. It is a credit to you and to the University.

Very sincerely,

WALKER L. CISLER,
President.

STRUCTURAL GLASS BRICKS

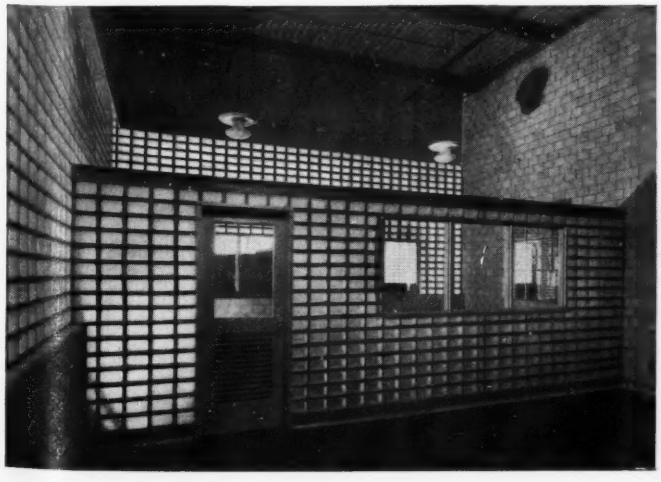
By JOHN G. TAMMEN, '39 C.E.

Cuts Courtesy The Architectural Forum

THE average American first became acquainted with glass bricks in 1933 at the Chicago World's Fair, where several all-glass houses were exhibited. Since that year the quantity of glass bricks used has increased many times. In five years a mere novelty has changed into a thriving industry. The unique properties of glass blocks are responsible for this fact. The variety and extent of their use in construction make this a rapidly growing industry.

The glass block now in use is a hollow, partially evacuated, water-clear unit of pressed glass construction. Essentially it is made by pressing two glass dishes together. A glass brick panel has a combination of the properties of a window and a wall. The different face patterns in the blocks give different percentages of light transmission. These values vary from 27.5% to 86.5% of the light falling on the block. Plate glass transmits 90% of the light which strikes its surface. The light which passes through the blocks is diffused so that it may be comparable to that coming from a skylight having a northerly exposure. The amount of diffusion and the particular type of diffusion is also dependent on the face pattern. The intensity of a light source viewed through a glass block is equal to 11.6% of the intensity of the light before it passes through the block. The value for plate glass is 90%. Thus it is apparent that while a glass block possesses nearly the same light transmission value as plate glass, the light is diffused and the brightness of any particular spot of light is greatly diminished.

A series of tests were made at the laboratories of Purdue University and several other laboratories on the properties of glass blocks, both individually and in panels. The ultimate strength of an individual block was found to be 800 pounds per square inch. When the glass blocks are built up in panels according to the specifications of the manufacturing companies, the ultimate strength becomes 400 pounds per square inch. In practice the safe load is taken as 100 pounds per square inch. In a test made on a panel 7 ft. 3 in. by 8 ft. 7 in., a loading of 80 pounds per square inch gave a deflection of .08 inches. This load is equivalent to a 163 mile an hour wind. The mortar joints of the wall showed a strength of 43.0 pounds per square inch in tension and 111 pounds per square inch in shear. The lateral strength of the blocks was tested by the application of pressure at their centers through 1½ inch cubes. They broke at loads from 560 pounds to 1290 pounds. The impact strength of a single unit is three foot pounds, i.e. a one pound ball dropped from a height of three feet is apt to crack the glass. When the unit is installed in a wall this value is greater since part of the shock is absorbed by the wall. In structural



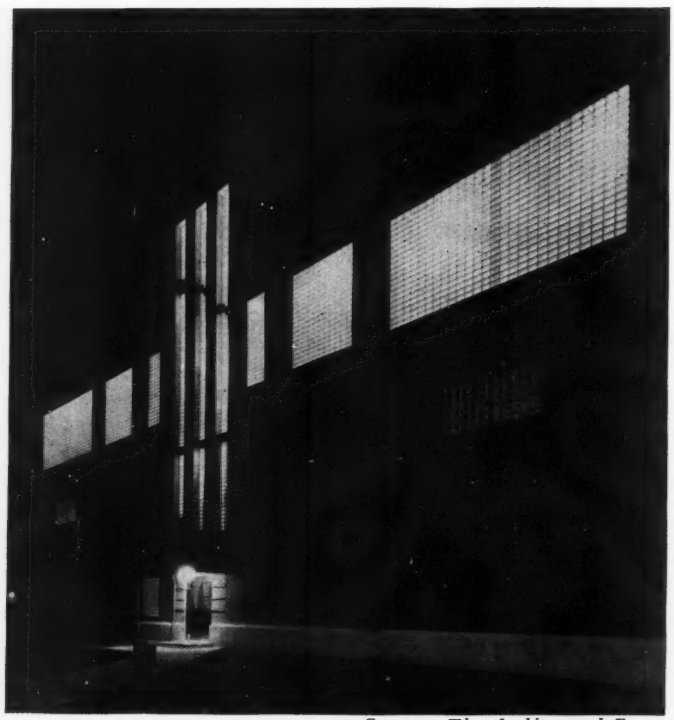
Partitions of Glass Reduce Noise and Improve Lighting.

strength, glass blocks are thus comparable to other wall materials.

The coefficient of expansion for one kind of block is .0000018 and for other principle kind the coefficient is .0000045. This second value is midway between the coefficient for brick masonry which is .0000030 and that for broken stone concrete which is .0000060.

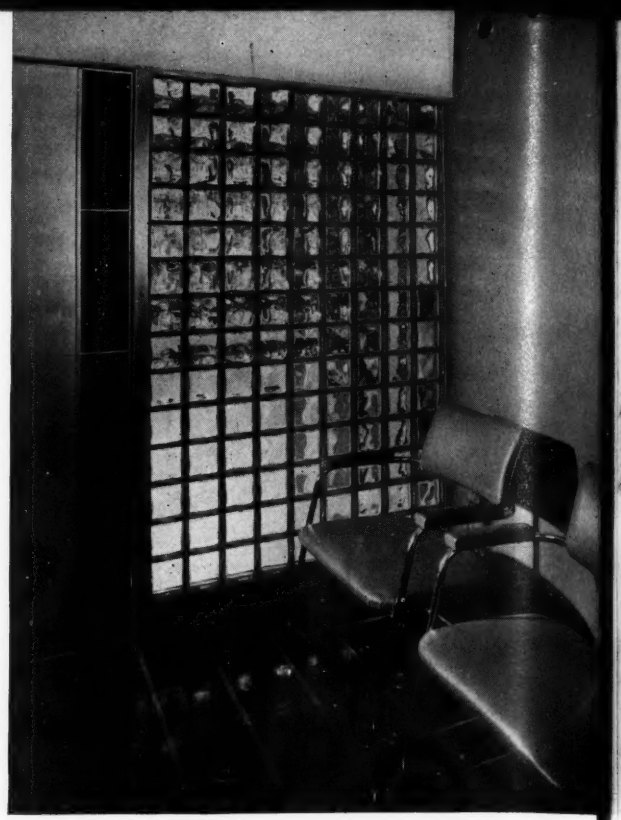
The air within the glass block is thoroughly dry and is in partial vacuum. This rarified dead air forms an excellent heat insulating unit. It has an insulating coefficient for a wall 3⅞ in. thick of 0.29 B.t.u.'s per hour per square foot per degree fahrenheit difference in temperature. This is based on a 15 mile an hour wind. The coefficient for single thickness window glass is 1.13, for double 0.45, and for triple 0.28. The coefficient of a plastered brick wall 13 inches thick is approximately 0.29. The high insulating value makes this material especially useful in tobacco factories, silk mills, paper mills, dairies, and other buildings where a high humidity is maintained.

Under average conditions condensation forms on the inside of windows during cold weather. This condensation causes deterioration of the sash and the surrounding materials. The outside temperature necessary to produce condensation on the inside surface, when the inside air is 70 degrees and the relative humidity is 40%, is —16.4 degrees for glass block and 36.0 degrees for steel sash. The infiltration of air through cracks around openings is reduced to a minimum by the use of glass blocks. These advantages of glass



—Courtesy The Architectural Forum

The Modern Factory Has Glass Brick Windows.



Borrowed Light Illuminates This Room

brick cause a reduction in the cost of air conditioning and artificial heating, both in the initial and maintenance costs. One test based on the yearly average temperature for New York City showed a saving of one ton of coal per season for every 100 square feet of glass panel surface.

In a test made on the solar heat transmission value for a particular block having a light transmission value of 78.5%, under continual exposure to the sun, 38.3% less heat was allowed to pass through than through a steel sash. With an eastern exposure the value was 37.7%. To the south the figure was 51.5% and to the west the value was 48% less than that for plate glass. The use of glass blocks therefore reduces the load on air conditioning equipment.

Glass block compares favorably with the usual type of plastered partition in sound reduction. Its average sound reduction factor or transmission loss was found to be 40.7 decibels.

The penetration of moisture through a glass block panel was tested by laying the panel horizontally and covering it with a three inch layer of water. It was left in position for a week. At no time was any trace of water found on the under side of the mortar joint. In another test a panel which had been exposed to the weather for a year was exposed to a spray for twenty seven hours and there was no appearance of moisture on the other side.

The construction of a glass brick wall follows specifications which I shall mention in general. All mortar bearing surfaces shall have a tolerance of ±⅛ inch.

(*Continued on page* 26)

THE INDIVIDUAL CORPORATION

By MAXWELL M. UPSON

President—Raymond Concrete Pile Co.

WHEN you reach the age that permits you to review calmly several decades of effort in retrospect, and measure accurately the accomplishments and failures, you will experience a real thrill when you encounter youth about ready to begin the voyage of life. There is ever the temptation to try to warn them of the reefs and hidden shoals that you know so well; yet an unwritten law always prevents. Youth will gladly be taught the theorems of Euclid and the conjugation of an elusive verb, but balks at instruction on honesty, character, religion, ideals, relationship with his fellowman and the influences of the little niceties of life. That is Sunday-School stuff—teaching for kids—not for men. Youth must learn from experience, and he who would bridge the gap opens himself to the taunt of preacher and pedant. Youth and age can never see in parallel lines. And perhaps it is best so; otherwise the advantages of education would overpower the man who has been deprived of it. As it is, frequently the man of little learning is a compendium of knowledge.

The subject of discussion has to do with the many factors other than those found in books which count for a man's success. It is perhaps best illustrated by taking apart a modern corporation and showing why it succeeds more easily than the individual. With your permission, I shall follow this analogy somewhat in detail, in the hope that it may stimulate thought and inquiry on your part.

Frequently, engineers like to take things to pieces just to see if they can be put together again. I suggest that this be done with the modern corporation; perhaps valuable secrets will be disclosed.

As you all know, a successful operating corporation is made up of many departments. Each assumes control of a definite function which is essential to the operation and growth of the business. If the enterprise is to succeed, the men who operate these departments must be expert and skilled in each of their particular fields.

The Advertising Manager and his corps must understand public psychology.

The Manager of Sales must know the trade and the value of his product as measured by his competitors' product.

The Production and Manufacturing Department must turn out a product of superior quality at minimum cost.

The Personnel Department must select the individuals who are to make up the members of all these activities, and fit the square pegs into the square holes.

And over all these and many more, the Chief Executive or Managing or Policy Committee, presides.

It is a great machine that functions well if all the gears are meshed and the bearings are kept oiled, and breaks down woefully or is wrecked when any of the component parts fail to perform.

ANALOGY BETWEEN THE INDIVIDUAL AND THE CORPORATION

It is my purpose in this article to draw an analogy between this corporate setup and the individual. It is my hope that in so doing I may impart to you some of the lessons that have been learned only by bitter experience over a period of many years.

So we come to the consideration of the individual corporation. In this, the individual must play all the parts of the score. He must be designer, producer, advertising agent, salesman, and most of all, managing director and policy committee. It is a big job and a complicated one. No one individual can hope to play all the parts one hundred percent; but as in a small corporation, a good job is often done with low priced and mediocre heads of departments. The important factor is that the job be taken seriously and performed energetically.

I wonder how many of you men have given a

thought to your Advertising Department. It is mighty important if you want to sell your goods. Great sales agencies tell us the first aim of any sales campaign is to establish confidence. People will not buy until they believe. This comes from making good on everything you say—on no misrepresentation—on no foolish claims—and best of all, on a satisfactory past performance.

I encounter many student applicants for engineering jobs who tell me they are enthusiastic about their work and are willing to make any sacrifice to succeed. Yet their records disclose mediocre marks, little accomplished in extra curricular activities, and no summer experience. The Advertising Department is making representations that facts do not support.

I have known a misstatement of fact by a publicity department to threaten ruin to a big corporation. Deception in any department usually is indicative of grave character weakness in the executive committee or management. This adds to the lack of confidence and builds up sales resistance.

I find scores of applicants for a position of responsibility who write a letter in English that would shame a bright grammar school youth and which carries only a fraction of the information that an analytical executive must have to determine his fitness for the position. Again the Advertising Department is deficient.

An eminently successful concern spent tens of thousands of dollars on samples of covers for the package which carried their product, because they wanted to give the impression of neatness and efficiency. So, too, I know many men of mediocre ability who hold their positions due largely to their careful attention to their grooming and good manners. A neat appearance counts much in your advertising policy.

Again, I recall a man of marked ability who makes a good income but fails to move into a much more lucrative position, because of the false economy of wearing cheap, ill-fitting and untidy clothes. He does not look successful, yet he has all the necessary mental abilities and personal charm. The best product is handicapped if the container is unattractive.

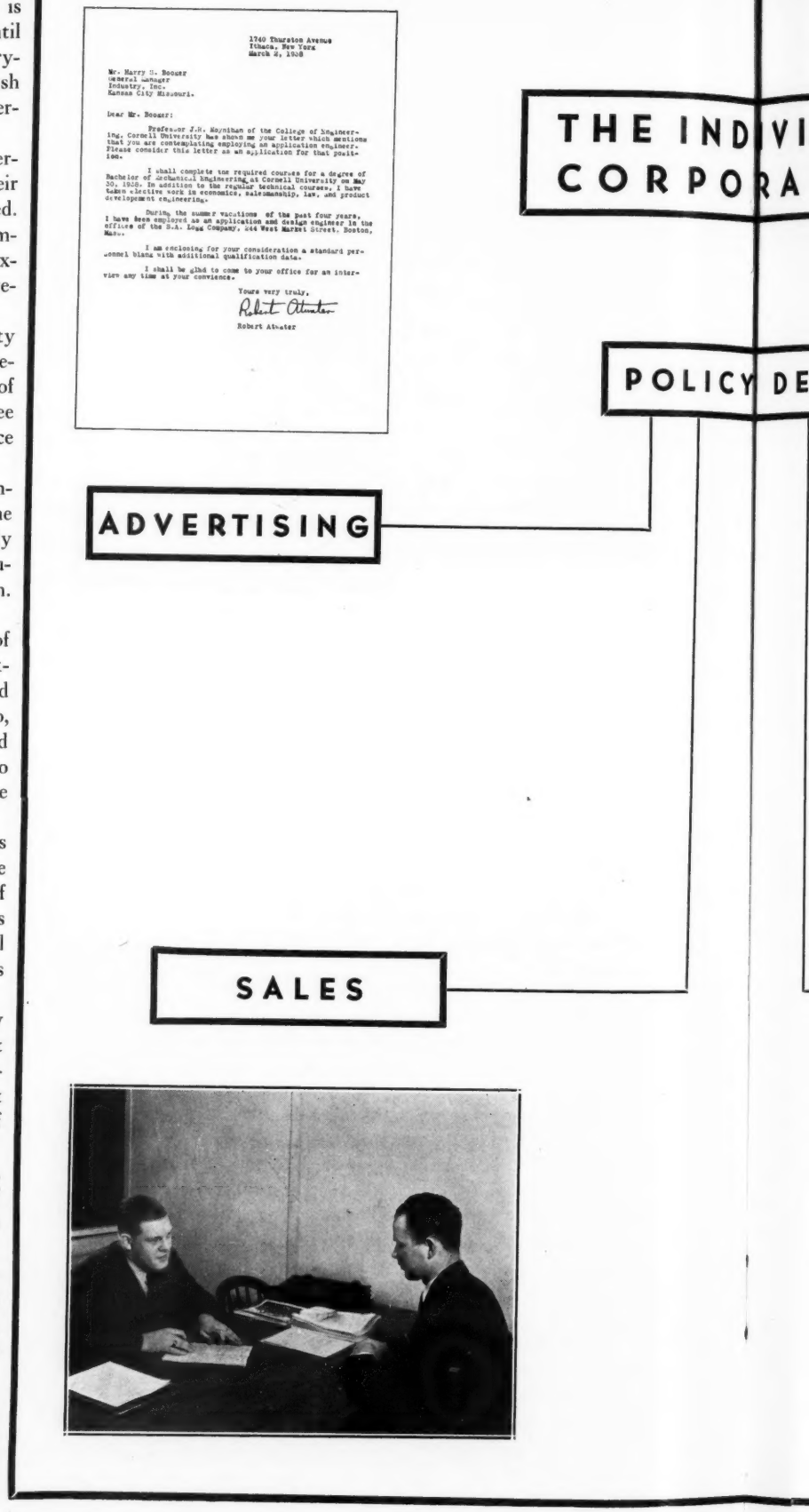
Yet, you say, I know successful men who really look like tramps. True; and it is for this reason that believing in the rules of life is sometimes difficult. Exceptions prevail, but in most instances they are brought about by the presence of great genius. For most of us this rare asset can not be used as an excuse.

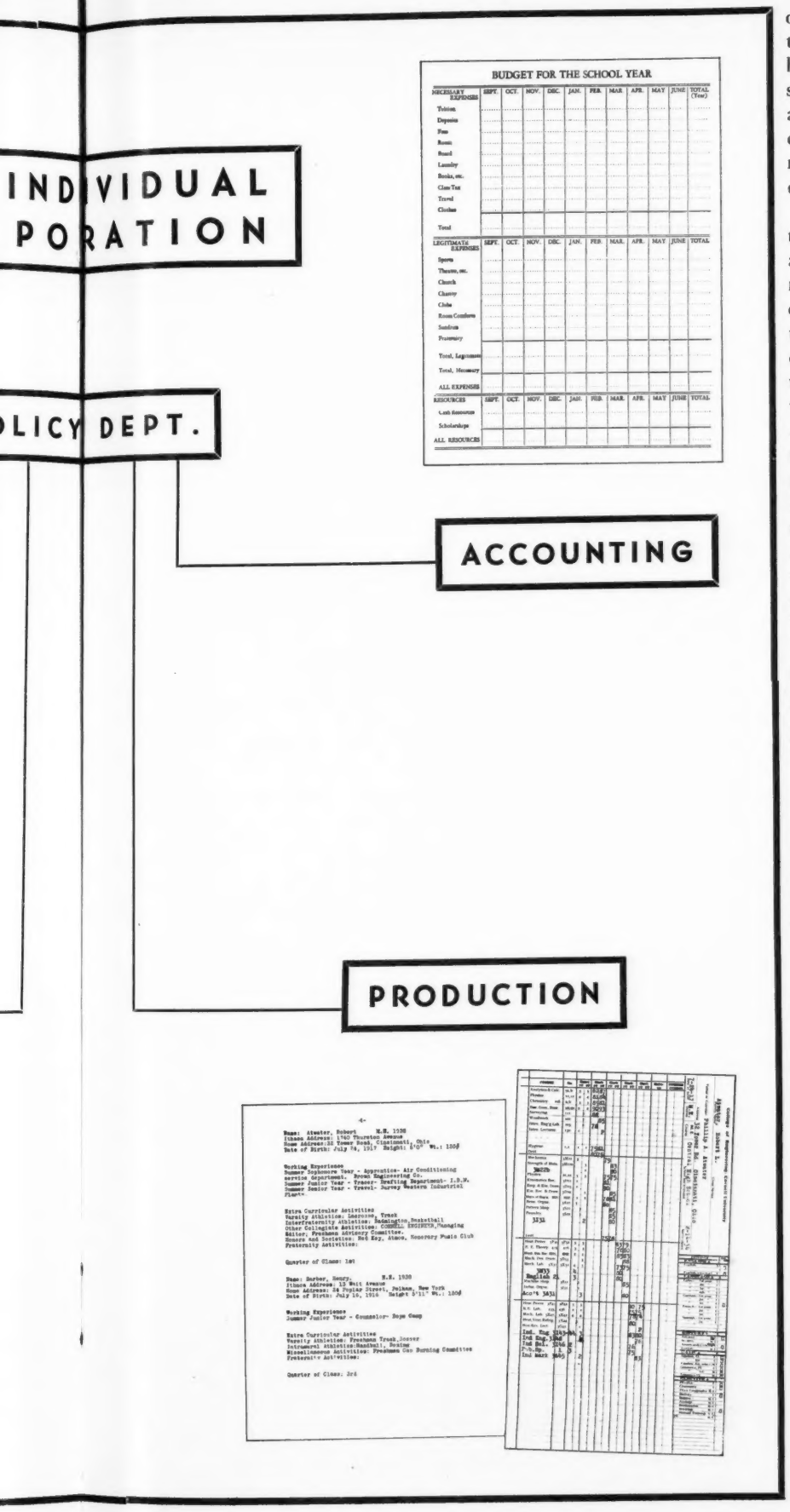
I know a man of marked distinction in politics, philanthropy and business; yet the officers of some of his companies dislike to introduce him into a business conference because of his unprepossessing appearance.

In selling ourselves, we find that external appearance must be backed by a pleasing personality. We must act well as well as appear well. Good manners, consideration, the voice with a smile, are important advertising assets.

Sales Department

Closely allied to advertising, is sales. Advertising attracts attention, builds up confidence and stimulates demand. The salesman must turn these into actual


1740 Thurston Avenue
Ithaca, New York
March 2, 1928
Mr. Harry H. Booser
General Manager
Industry, Inc.
Kansas City Missouri.
Dear Mr. Booser:
Professor J.H. Moynihan of the College of Engineering, Cornell University has shown me your letter which mentions that you are contemplating employing an application engineer. Please consider this letter as an application for that position.
I shall complete the required courses for a degree of Bachelor of Mechanical Engineering at Cornell University on May 30, 1928. In addition to the regular technical courses, I have taken elective work in economics, salesmanship, law, and product development engineering.
During the summer vacations of the past four years, I have been employed as an application and design engineer in the offices of the B.A. Bean Company, 444 West Market Street, Boston, Mass.
I am enclosing for your consideration a standard personnel blank with additional qualification data.
I shall be glad to come to your office for an interview any time at your convience.
Yours very truly,
Robert Atwater
Robert Atwater
THE INDIVI
CORPORA
POLICY DE
ADVERTISING
SALES



orders. He does this by analyzing and understanding the wants of the customer. This means that he must be able to put himself mentally in the place of the prospective purchaser. A good salesman must have imagination and understanding of the viewpoint of the customer; he must have implicit confidence in the merits of his product. We can not sell anything successfully until we believe in it heart and soul.

I learned this when I was here at Cornell managing the SIBLEY JOURNAL of my day. I traveled from Minneapolis to New York, selling advertising. When I permitted my imagination to picture the sales resistance of the chief executive of a large corporation, and saw the hundred reasons why our readers could not purchase his product, and why in purchasing space he was wasting his money, I never succeeded. In consequence, when I found myself in this mood of lack of confidence and pessimism, I walked around the block for fifteen minutes or more until I had built up my belief in the merit of my advertising space. I reasoned that a great business must fix its name in the minds of the young engineers who some day would be the determining factors in the engineering world. Invariably after a mental regeneration of this character, I walked into the office of busy executives with perfect confidence and brought out an order.

Courage and confidence come from deep-seated beliefs that are built on truth. We need never compromise with facts. The important matter is to be sure we have them; we can then fight for them to the last ditch.

ETHICS OF SALESMANSHIP

The ethics of salesmanship are fully as important as our personal ethics. Complete knowledge of the merits and weaknesses of competitive products is essential; but great care must be used in disseminating unfavorable facts. It is just as much in bad taste to circulate gossip of weaknesses in competitors' products as it is to spread malicious gossip about acquaintances.

Sell on real merit, not on comparison. The purchaser usually knows what the market provides. Your important duty is to make sure that he knows all the advantages of your proposition. In doing this, it is sometimes possible to point out an asset in your product that does not exist in the competitive field; but this should be done without criticism or malice.

It is unnecessary to point out how essential this code is to a successful individual sales policy. Do not climb over others, climb with them. The best sales argument is performance. If you meet your delivery or completion dates, if your product is satisfactory, the repeat order comes easily.

Sometimes it is not realized that progress in business and life is nothing but a series of repeat orders. Many times I have seen repeat orders come to a corporation so frequently, and in such increasing volume, that the management began to look upon them as proprietary assets and forgot the obligations they incur. Suddenly, a new development of a competitor takes the business away, perhaps never to return. The obligation of continual improvement had been forgotten.

I recall a man in my employ who served the corporation with marked distinction for twenty years, when suddenly his effectiveness waned. He had been advanced and advanced until his income was twice that which he had dreamed of in his early career. The repeat orders had come rapidly and had resulted in overconfidence and complacency. One day I called him into my office and told him of his weaknesses. He was sure I was mistaken and that I was not quite appreciative of his efforts. Because of our long association and deep friendship, I saw that I was not impressing him with the seriousness of the situation. In consequence, I had to make this proposition to him: I said, "Jack, our long contacts have created an affection and friendship which I am sure will survive any business disagreement. You know that as chief executive of this company I would be unfair to my trust if I permitted friendship to weaken our organization. I would be unfair to you if I permitted a continuation of your present ineffective service; in consequence there are only two courses to pursue—either you tender your resignation immediately or you go back to your job at half your present salary and show us that you still have your old abilities." Without a moment's hesitation he chose the latter; and within a year he was back to his old efficient self with a larger income than ever before. He had the stamina—or as you say in athletics, the guts—to reorganize and recapture his repeat orders.

Production Department

Let us now give consideration to the production department. Without it, no corporation can live. The individual must produce several most important essentials: energetic and constant effort, loyalty, dependability, vision, courage, ingenuity and judgment. There is an unlimited demand for these products at all times. The difficulty is that the producer is often a poor judge of the quality of the product that he is turning out; he is satisfied if it is accepted, and is quite blind to the enormous market he is missing because his output does not satisfy the fastidious consumer.

It is an elusive goal that we strive for. A thousand disjointed, seemingly unrelated facts are poured into an individual, and he is supposed to assimilate, digest and turn them into the bread and butter of his employer. This means a masterly discernment of the essentials so that the unimportant do not impede the progress.

Principles must stand out as beacons to make sure against getting off the course. Remember always that the boss is ever on the lookout for a new idea, and would love to turn over many decisions to a subordinate if he thought he could trust him.

I recall the first raise I had when I was working for fifty dollars a month shortly after leaving college. My superior sent me to the Middle-West to make some changes in an electric power house. It was not an important mission, but because of my inexperience I was given very specific instructions. On my arrival at the plant I found conditions quite different from those that had been given me by my superior. In consequence I was forced to deal with factors that had not been discussed in the premises. To my mind this meant the employment of methods definitely at variance with my specific instructions. I realized that to disobey orders might mean the loss of my job, but I was so sure of my conclusions and so apprehensive of the results that might accrue if I adhered to instructions, that I took the chance of acting on my own judgment.

When I returned to New York and reported to my chief, I was immediately asked if I had complied strictly with the advices that had been given me. When I admitted that I had not, I was not given time to explain and was read an unabridged lecture on the first principles of obedience and adherence to instructions. Beginning to realize the enormity of my deed, and expecting every minute to receive a dismissal, I hardly had courage to set forth the reasons for my disobedience. Finally, on having presented my case, my chief got up and shook me by the hand and said, "My boy, you're right. Next month your salary is going up a notch. That sort of thinking is what this firm wants."

I found out afterwards that I had not been astute enough to foresee all the calamities that might have resulted had specific instructions been explicitly adhered to. So you see I played somewhat in luck.

However, the lesson of courage of action after a careful review of all the factors of a problem was thoroughly implanted in my mind. I had placed myself in a position to receive worthwhile "repeat orders." From that time on I noticed that I was selected for commissions requiring ingenuity and judgment. I had been moved out of a rut.

The catching of the eye of the boss isn't such an easy game. It requires infinite patience and constant alertness. The opportunities come infrequently and suddenly. The usual procedure is the suggestion of some improvement either in quality or costs. Be sure you know every detail of a problem before you discuss it with your superior. Nothing weakens the standing of a young man more than the presentation of a half thought-out plan with an obvious lack of consideration of some of the important factors. This discloses shallowness and lack of ability to think a problem through. On the other hand a new thought or a new viewpoint delights the heart of the boss and causes him to consult you from time to time. You become a partner in thought instead of a hireling.

Ed. Note.—*The second and concluding part of Mr. Upson's article, "The Individual Corporation" will appear in the November issue of* The Cornell Engineer. *In it the author elaborates on his analogy between the Individual's Sales Department and that of the Corporation and takes up the Cost and Personnel Departments.*

NEWS of the Engineering Campus

PROFESSOR BANGS PRESENTS CRITIQUE TO MANAGEMENT CONGRESS

Professor John R. Bangs, Jr., head of the Department of Administrative Engineering in Cornell University, has contributed a critique of a series of papers on manufacturing management to one of five books printed in advance of the Seventh International Management Congress, to be held in Washington, D. C., Sept. 19-23. As a basis for oral discussion at the meeting, papers on this subject have been gathered from M. W. Smith, manager of engineering, Westinghouse Electric and Manufacturing Co.; A. H. Robinson, assistant treasurer, Eastman Kodak Co.; Edward T. Gushee, vice president, the Detroit Edison Co.; F. Albert Hayes, general purchasing agent, American Hide and Leather Co.; C. P. Turner, of Paton, Calvert & Co., England; Professors Mario Ponzo and Ferrucio Banissoni of Italy; John R. Blades, insurance adviser, New York City; W. J. Cameron, Ford Motor Co.; Pal Plosz, Hungary; and Ferdinand Liszievicz, Hungary.

These papers are summarized by Professor Bangs in his printed critique which he will also deliver orally at the session in Washington. Some of the important problems considered are the present facilities for research in America, with their various functions and the possible danger of regimentation by the Federal Government; coordination of manufacturing and selling operations to bring about systematic control of production, inventories, and the employment of labor; effective purchasing policies to cut the cost of production by eliminating waste and controlling the quality of materials as well as the price; simplified systems of comprehensive planning and accounting; the Ford plan of decentralizing manufacturing; the use of insurance; and programs involving universities, municipalities, and national governments in Italy and Hungary.

Of the papers as a group, Professor Bangs says, "Certain important things are lacking . . . The human side is one of the most important elements of manufacturing management and, although many of the papers mentioned it in passing, the scope of their own particular assignments prevented the proper development of this all-important aspect of manufacturing management. All industry is based on a foundation of individuals, of personalities, and unless we have leaders who can direct these individuals, manufacturing management techniques can never be truly effective."

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OUR "AMERICAN MEN OF SCIENCE"

Thirty-nine members of the faculty of the College of Engineering, Cornell University, are listed in the new edition of "American Men of Science" just off the press. The book contains biographical sketches of those who have made important contributions, directly or indirectly, to pure science, and therefore, in the field of engineering, is primarily a list of research workers. The number of Cornell engineering professors listed is more than 35 per cent of the faculty of the college.

Of the 39, five are emeritus professors: Deans A. W. Smith, Dexter S. Kimball, H. S. Jacoby, H. N. Ogden, and E. H. Wood. Dean S. C. Hollister leads the members of the active staff. Others are: from the School of Civil Engineering; P. H. Underwood, F. A. Barnes, E. W. Schoder, F. J. Seery, S. L. Boothroyd, E. W. Rettger, C. L. Walker, H. H. Scofield, and L. C. Urquhart; from the Sibley School of Mechanical Engineering: Director W. N. Barnard, C. D. Albert, F. O. Ellenwood, W. M. Sawdon, G. B. Upton, V. R. Gage, F. G. Switzer, A. C. Davis, Jr., W. R. Cornell, C. O. Mackey, and J. N. Goodier; from the School of Electrical Engineering: Acting Director P. M. Lincoln, V. Karapetoff, W. C. Ballard, Jr., R. F. Chamberlain, B. K. Northrop, E. M. Strong, M. G. Malti, W. E. Meserve, and H. Sohon; from the School of Chemical Engineering: Director F. H. Rhodes, C. W. Mason, and A. W. Laubengayer, as well as Professors Barnard and Davis; and from the staff of the Engineering Experiment Station, T. R. Cuykendall as well as all six members of the Experiment Station Council.

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STUDENT REGISTRATION SHOWS MARKED INCREASE

With important additions to faculty and equipment, and with a new School of Chemical Engineering added to the established schools of civil, mechanical, and electrical engineering, the College of Engineering at Cornell University anticipates the largest freshman class in many years. Admissions to the entering class have already passed the total freshman enrollment last year. On the comparable date last year, only two-thirds of the class of 348 had been admitted. Another 100 students will be added to the total enrollment from the upper classes, which are larger than the comparable classes in 1937.

So great has been the demand for entrance to the School of Chemical Engineering that the number of freshmen has been limited to approximately 100, with one applicant out of three gaining admission. The other schools will approach capacity, and are considering the advisability of adopting a plan of selective admissions for the future. Dean S. C. Hollister attributes the situation primarily to increasing effectiveness of alumni co-operation with the University in the general program of relations with secondary schools.

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APPLIED MECHANICS CONGRESS

Three members of the faculty of the College of Engineering presented papers at the Fifth International Congress for Applied Mechanics held at Cambridge, Mass., under the auspices of Harvard and M.I.T., September 12-17. The Congress brought together about 300 scientists from Europe, the Orient, and America to hear and discuss a series of technical papers in such fields as elasticity, lubrication, vibration, strength of Materials, fluid mechanics, airplane dynamics, plasticity, river flow, and heat transfer.

Professor J. N. Goodier, who joined the Engineering faculty this summer, spoke on the subject, "On the Theory

COLLEGE NEWS

of Dislocations and an Application to Plane Stress Problem of a System of Forces Acting at a Hole," Professor H. C. Perkins presented "A Graphical Torsion Analysis," and Dean S. C. Hollister delivered one of six general lectures. His address celebrated the tercentenary of the publication of Galileo's "Two New Sciences."

Professor F. G. Switzer and G. H. Lee of the Cornell Engineering faculty also attended the Congress.

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LECTURES BY DEAN AND NEW PROFESSOR

Dr. J. N. Goodier, who joined the faculty of the College of Engineering, Cornell University last July as acting professor of mechanics, delivered a special lecture July 23, at the University of Michigan. His subject was "Applications of the Theory of Elasticity in Analyzing Thermal Stresses." Widely known for his research in the fields of elasticity, plastics, and advanced dynamics, Professor Goodier has spent the last seven years as a fellow in applied mechanics at the Ontario Research Foundation. He holds doctorates from Cambridge University, England, and the University of Michigan.

Another lecture in the same series at Ann Arbor was given Friday, July 29, by Dean S. C. Hollister of the College of Engineering. His subject was "Applications of Elasticity to the Design of Pressure Vessels."

Dean Hollister is the author of a chapter on "Stress Relieving" in **Welding Handbook** just published by the American Welding Society. Beside several committee reports and other general material, the book has sections on processes, materials and metallurgy, testing, welding applications, and critical digests of welding literature.

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MAY WE PRESENT THE NEW FACULTY MEMBERS

Additions to the faculty include Dr. William Lindsay Malcolm as director of the School of Civil Engineering, Dr. J. N. Goodier as acting professor of mechanics in the Sibley School of Mechanical Engineering, and Dr. Oscar J. Swenson as assistant professor of chemical engineering. Dr. Malcolm, one time lieutenant-colonel of Canadian Engineers, comes to Cornell froms Queens University, Kingston, Ontario, where he was professor of municipal engineering. Professor Goodier, who holds doctorates from Cambridge University, England, and the University of Michigan, has been research fellow in applied mechanics at the Ontario Research Foundation since 1931. Professor Swenson has taught at the University of Minnesota and for three years has been a chemical engineer with the E. I. duPont de Nemours Company.

Establishment of the School of Chemical Engineering has made Dr. F. H. Rhodes, the new director, a full-time member of the engineering faculty, and has given seats on the engineering faculty to Professors C. W. Mason and A. W. Laubengayer of the Department of Chemistry. Dr. Lynn A. Emerson, former assistant superintendent of schools in Yonkers, has been appointed professor of industrial education, with membership in the faculties of the Engineering Division of the Graduate School and the Graduate School of Education, to inaugurate a program of reasearch in industrial and technical education. Raymond F. Howes, formerly of the staff of the Cornellian Council, has become assistant to the Dean.

The list of new instructors is still incomplete and will appear in the next issue of the CORNELL ENGINEER.

McMULLEN SCHOLARSHIP WINNERS

Cornell University has awarded 31 McMullen Regional Scholarships in Engineering to secondary school graduates from 20 states, President Edmund E. Day announced today. Each successful competitor will receive $400 a year during his career in the College of Engineering provided that satisfactory scholarship is maintained. These scholarships, established from the fund bequeathed to the University by the late John McMullen of Norwalk, Connecticut, "for the purpose of creating and maintaining free scholarships for the education of young men as engineers," are awarded annually to secondary school graduates in 15 districts covering all of the United States except the State of New York, students in New York State being eligible for other scholarships.

This year's scholars, selected by the faculty of the College of Engineering with the assistance of regional alumni committees, were picked from 294 applicants representing 38 states and the District of Columbia. In September, 29 will enter as freshmen and two, who are filling vacancies, as sophomores, bringing the total number of McMullen Regional Scholars in the College to approximately 100.

Winners of Scholarships and alumni committee chairmen in the 15 districts follow:

I (Maine, N. H., Vt., Mass., Conn., R. I.), Ralph H. Brown, Milford, Conn., Frank W. Silcox, Jr., Newport, R. I., and LaRoy Thompson, Tilton, N. H. Alumni chairman, Chester T. Reed, Worcester, Mass.

II (Pennsylvania), Richard Belyea, Upper Darby, Thomas I. Kennedy, Llanerch, and B. J. Walker, Erie. Chairmen, Thomas F. Crawford, Philadelphia, and E. C. Batchelar, Pittsburgh.

III (New Jersey), Norman L. Christensen, Englewood, George F. Critchlow, Trenton, and James H. Moore, Jr., Montclair. Chairman, G. G. Terriberry, New York City.

IV (Del., Md., Va., N. C., S. C., D. C.), Rickford J. Hanner, Charlotte, N. C., James W. Hart, Baltimore, Md., John M. Mylroie, Jr., Fairfax, Va., and Norman T. Nelson, Baltimore, Md. Chairmen, Creed W. Fulton, Washington, D. C., and W. E. O'Neil, Richmond, Va.

V (Ga., Fla., Ala., Miss., La.), James W. Cochrane, Augusta, Ga., and Carl Green, Jr., Coral Gables, Fla. Chairmen, J. D. Willcox, Birmingham, Ala., and A. B. Morrison, Miami, Fla.

VI (W. Va., Kentucky, Tenn.), William H. McDonald, Jr., Mt. Hope, W. Va. Chairman, N. W. Dougherty, Knoxville, Tenn.

VII (Ohio), Edmund W. Hostetter, Jr., Zanesville, and John Slauta, Cleveland. Chairmen, F. W. Krebs, Cleveland, and Otto Hilmer, Cincinnati.

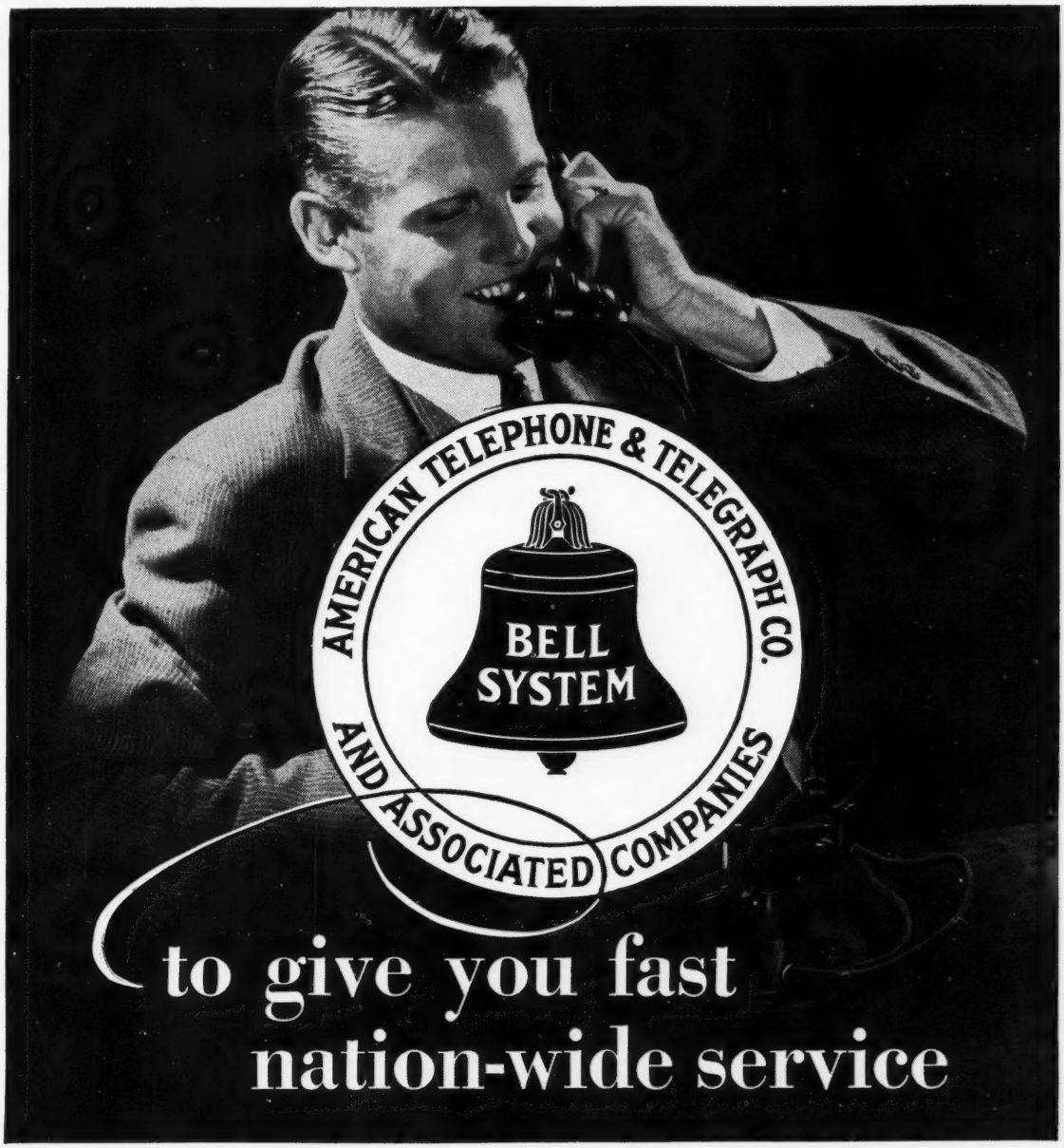
VIII (Indiana, Michigan), James L. Kraker, Jr., Beulah, Michigan, David J. Nelles, Detroit, Michigan, and Mircea R. Sfat, Jackson, Michigan. Chairman, Matthew Carey, Detroit, Michigan.

IX (Illinois), William C. Fleming, Chicago, Gordon Kiddoo, Winnetka, Frank C. Smith, Wilmette, and William H. Webster, Hinsdale. Chairman, Alfred H. Hutchinson, Chicago.

X (Tex., Okla., Ark.), R. H. Grant, Jr., Denison, Tex. Chairman, J. G. Pew, Dallas, Texas.

XI (Mo., Nebr., Kansas), Louis W. Mead, St. Louis.

(*Continued on page* 20)



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COLLEGE NEWS

McMULLEN WINNERS

Mo. Chairmen, Shurly R. Irish, St. Louis, Mo., and John W. Towle, Omaha, Nebraska.

XII (Iowa, Wisc., Minn.), John H. Halgren, Menomonie, Wisc., and William N. Kruse, Davenport, Iowa. Chairman, C. S. Whitney, Milwaukee, Wisconsin.

XIV (Colo., Ariz., N. Mex., Nev., Utah), David W. Milhan, Pueblo, Colo. Chairman, G. A. Gould, Denver, Colo.

XV (Calif., Ore., Wash., Idaho), Paul W. Leighton, Twin Falls, Idaho. Chairmen, O. W. Fisher, Seattle, Wash., Carroll R. Harding, San Francisco, Calif., and Sterling Lines, Los Angeles, Calif.

No award has been made in District XIII (N. D., S. D., Mont., Wyo.) of which Pitt Covert, Jr., of Casper, Wyoming, is chairman.

●

WHAT'S HAPPENED TO THE BUILDINGS AND APPARATUS?

A program of improving the facilities of the College of Engineering, including the installation of new equipment, regrouping of laboratory apparatus, classrooms, and offices in more convenient units, and work on the exteriors of several buildings, has been undertaken during the summer by Cornell University. The Sibley buildings, in particular, have undergone extensive remodeling.

In the East Mechanical Laboratory a section had to be removed from the outside wall and a pit dug below the level of the first floor to install a new Olsen tension-compression testing machine, which by hydraulic power can apply forces up to 200,000 lb. This machine, which has a pendulum weighing mechanism, can take five-foot specimens. It will be used both for undergraduate instruction and for research in testing iron, steel, non-ferrous metals, and other types of material used in engineering construction. Regrouped in the laboratory on new concrete bases are three smaller machines for the same purpose, as well as other machines for testing by torsion, transverse bending, impact, etc. Other equipment in the Sibley School of Mechanical Engineering, the School of Civil Engineering, and the School of Chemical Engineering makes it possible now for students and faculty to make almost any known test of materials.

On the second floor of the same building, the machine shop has been moved, a new motor drive for all machinery has been installed, and a new band saw and equipment for welding, sand-blasting, etc., are being installed.

In the West Mechanical Laboratory, preparations are under way for the construction of a constant-temperature room for heat-transfer tests, humidity control, and various other research projects in air-conditioning and related heating and ventilating problems. A new stairway has been built from the first floor to the second, and office and classroom space will be rearranged.

The Mechanical Engineering library in Sibley Dome has been moved to the top floor, taking the space formerly occupied by the assembly room. Books will be stored in steel stacks on a concrete floor, making the entire storage space fire-proof. The reading room will be considerably larger than formerly, and may be further expanded in the future by using the balcony.

Offices will now fill the entire first floor of the Dome. The Dean's Office has been enlarged, and new offices have been constructed for the administrative staff and the Personnel and Employment Department, including several conference rooms for the use of representatives of industries who come to the campus to interview students. Modern lighting equipment is being installed throughout. Both East Sibley and West Sibley have been connected with the Dome by fire-proof doors, making Sibley Hall at last a single coherent unit.

Rand Hall will have extensive repairs made to the exterior as the result of a gift from Mrs. Florence Rand Lang, donor of the building.

Extensive changes were made earlier in the year for the School of Civil Engineering. A new graduate students' shop and a computing room were constructed in the North end of Lincoln Hall, using the space formerly occupied by a mammoth testing machine, and the photo-elastic laboratory was improved by additional apparatus, new lighting fixtures, and redecoration.

●

WE RECEIVE A 600 H.P. AIRCRAFT ENGINE

A Wasp SIHI-G airplane engine, completely equipped for laboratory operation, has been shipped to the College of Engineering, Cornell University, by the Pratt and Whitney Aircraft Company, it was announced recently. The engine will be added to the extensive equipment of the Sibley School of Mechanical Engineering.

According to J. Carlton Ward, Jr. '14, assistant general manager of the company, who announced the gift, this engine is used in Curtis SOC scout observation planes for the U. S. Navy, North American basic training planes for military services, Pan American Airways, "Electra" planes operating in North and South America, Fairchild planes built in Canada, Seversky basic combat planes, Northrop all purpose planes, Noorduyn "Norseman" models used in Canada for commercial and military purposes, North American combat planes operated in England and Australia, Faucett planes built in Peru, Bellanca "Skyrocket" planes, and Boeing 247 transports operated by various airlines in this country and in South America It is a nine cylinder, radial, air cooled engine developing 600 H.P. for takeoff use.

With the engine will come a complete set of charts, booklets, and other explanatory material for purposes of instruction. Members of the engineering faculty consider the engine an outstanding piece of motive power, which will be an important addition to the laboratory facilities already available for work in aeronautics.

●

NEW EQUIPMENT IN FRANKLIN HALL

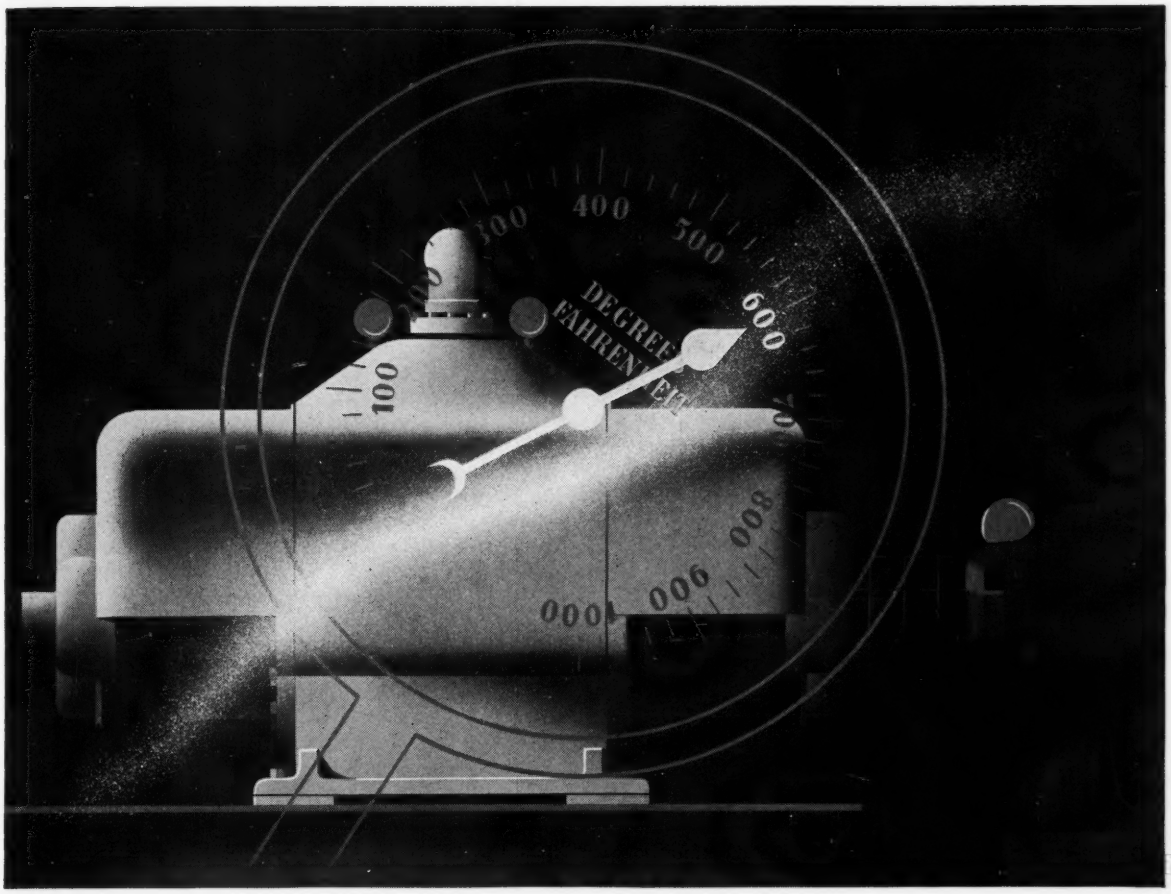
There have been a number of additions to the experimental equipment of the Electrical Engineering School. Included is a Schering Bridge for accurate measurement of dielectrics, an electric oven for drying coils and for controlling the temperature on samples of test material, an experimental transmission line, and magnetic testing equipment.

●

ADVANCED ENGINEERING DEGREE

At commencement in June, only one degree of Doctor of Philosophy in Engineering was given. This was to Mr. Eugene Tu in Civil Engineering. There were two Ph.D's. given last February and one last September.

ED. NOTE.—*Remember, we welcome your criticisms on the makeup of this department. Address News Editor.*



BETTER MATERIALS FOR HIGHER TEMPERATURES

NEW developments bring new problems. The designing of an improved direct-drive steam engine, for oil-field service, necessitated the use of a material that would withstand continuous subjection to high steam temperature (550° to 600°F.).

The manufacturer adopted a Chrome-Nickel-Moly (0.50—1.00% Mo) iron for vital engine parts. Due to its Moly and Chromium contents, its high growth resistance assures maintenance of the close tolerances necessary to efficient engine performance.

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WHICH HAVE YOU READ ?

We are constantly hearing of the plight of the circumscribed engineering graduate and of the importance of *well chosen* outside reading to remedy his lack of understanding of the world about him and the people who inhabit it. Why not, we thought, present the list of books recommended by one enabled by experience to judge good reading, one who has spent his time trying to increase the effectiveness of education for engineers. Let this list be a nucleus of worth while stories to serve as a guide to outside reading for those who wish to augment their technical training with experiences of a broader nature. The location of our College of Engineering in a great University increases our opportunity to learn about the world outside our chosen field; our reading can do much more if not allowed to drift into unimaginative channels. So we are publishing Dean-emeritus Dexter S. Kimball's recommended list for Administrative Engineers, as a worth while guide to all hoping to leave the college with more than a necessarily limited technical training.

Dean Kimball draws from experience in an advisory capacity for the McGraw-Hill Company, and from his progressive work in the field of engineering education, which includes the founding of the present Administrative Engineering curriculum. His work as Dean of the College of Engineering at Cornell and his position of President of the Society for Promotion of Engineering Education signify his earnest desire to help us find a thorough education in our college course. That is why we chose his list.

In the spring of the year, sophomores in Administrative Engineering receive this list for use during the summer, this because vacation time offers the greatest opportunity for reading. In publishing it for the whole undergraduate body for use at all times, we hope the class of '42 will be particularly interested in it, and thus realize early the responsibility each individual has in making his college course a success. Taking the initiative in developing his own curiosity and intellect through balanced reading is one important step; he must, however, heed the warning not to regard it as a panacea.

Title	*Author*
"Ancient Times"	James H. Breasted
"George Washington"	Woodrow Wilson
"Life of Abraham Lincoln"	Lord Charnwood
"America Comes of Age"	Andre Siegfried
"Seven Great Statesmen"	Andrew D. White
"From Immigrant to Inventor"	Michael Pupin
"English & American Tool Builders"	Joseph Wickham Roe
"Science Remaking the World"	Caldwell & Slosson
"Foundations of the Universe"	M. Luckiesh
"Nature of the World and Man"	Newman and others
"Microbe Hunters"	Paul DeKruif
"Human Life as the Biologist Sees It"	Vernon Kellogg
"Revolt in the Desert"	T. E. Lawrence
"The Iron Puddler"	James J. Davis
"How We Think"	John Dewey
"Two Views of Education"	Lane Cooper
"The Story of Philosophy"	Will H. Durant
"What Men Live By: Work, Play, Love, Worship"	Richard C. Cabot
"A Book of the Operas"	H. E. Krehbiel
"Robinson Crusoe"	Daniel Defoe
"With Fire and Sword"	Henry Sienkiewicz
"Kidnapped"	Robert L. Stevenson
"Kim"	Rudyard Kipling
"Two Years Before the Mast"	Richard H. Dana, Jr.
"The March of Democracy"	C. F. Miller
"The Epic of America"	James Truslow Adams
"Influencing Human Behavior"	H. A. Overstreet
"David Copperfield"	Dickens
"Vanity Fair"	Thackeray
"The Return of the Native"	Hardy
"Death Comes for the Archbishop"	Cather
"My Antonia"	Cather
"A Son of the Middle Border"	Hamlin Garland
"The Oregon Trail"	Parkman
"Far Away and Long Ago"	Hudson
"Green Mansions"	Hudson
"On Liberty"	John Stuart Mill
"A Preface to Morals"	Lippmann
"Ethan Frome"	Edith Wharton
"The Good Earth"	Pearl Buck
"The Autobiography of Andrew D. White"	
"Progress and Poverty"	George
"The Autobiography of Benvenuto Cellini"	
"Pepys Diary"	
"Felix Holt" or other books by	George Elliott
"A Tale of Two Cities"	Dickens
"Scaramouche"	Sabatini
"The Adventures of Francois"	S. Weir Mitchell
"Treasure Island"	Robert L. Stevenson
"The Master of Ballantrae"	Robert L. Stevenson
"Inheritance"	Phylis Bentley
"With Napoleon in Russia"	de Coulaincourt
"The Next Hundred Years"	C. C. Furnas
"Seven Pillars of Wisdom"	T. E. Lawrence
"How to Win Friends and Influence People"	Dale Carniege

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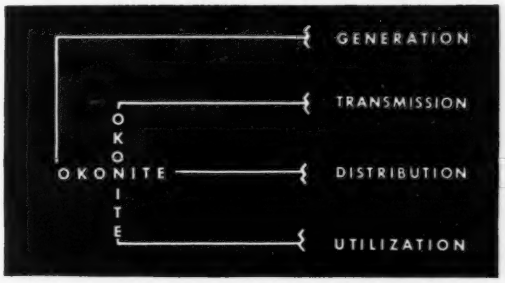

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News of the Alumni

WILLIAM REUBEN WEBSTER '90, one of Cornell University's most distinguished graduates in mechanical engineering, is the subject of a biographical sketch by Paul E. McKinney in the May number of **Metal Progress,** official organ of the American Society for Metals. Last year he completed 40 years of service with the Bridgeport Brass Co., which he joined in 1897 as foreman of the rolling mill and of which he is now chairman of the board. "He had the good fortune," says the article, "to come to the brass industry with an engineering training and an engineering way of doing things at a time when the industry was carried out entirely by rule-of-thumb. He had the strength of character to break down many rock-bound traditions, even then quite out-dated, and in this he had the assistance of other engineers, who early in his career he gathered about him, and who found many ways to put their theoretical training to good use in a practical way."

"William Reuben Webster, therefore, represents the engineering pioneer in the brass industry, and as such the metallurgist of today delights to honor him."

As examples of his pioneering, the author cites his early use of electricity for melting copper, his work in developing modern condenser tubes, his ingenuity in developing new mechanical conversion operations for quantity production, and his evaluation of raw materials, "of immeasurable value in the efficient production of ample munitions" during the World War.

Mr. Webster has been for many years a member of the American Society for Testing Materials and the American Society of Mechanical Engineers, holding important committee posts in both organizations. He is a member of the Advisory Committee on Non-Ferrous Alloys and Metals of the U. S. Bureau of Standards, chairman of the Committee on Non-Ferrous Pipes and Tubes of the American Marine Standards Committee, and past chairman of the A.S.M.E. Research Committee on Condenser Tubes.

In Bridgeport he holds many positions of civic trust and responsibility. He was one of the founders of the Charity Organization Society of Bridgeport, and is currently president of the Bridgeport Society for Mental Hygiene and director of the Family Welfare Society and the Y.M.C.A. In hours of relaxation from his strenuous duties, he is an ardent fisherman and golfer.

'06 ME—Thomas C. Gordon is executive vice-president of the Richmond Foundry and Manufacturing Company, Inc., Richmond, Va. His home is at 3507 Brook Road, Richmond.

'07, '08 ME—Walter W. Storm is with the Wilmington Iron Works, Wilmington, N. C.

'11 ME—Richard Meyer has been with Walter Eagan, 1612 Vine Street, Philadelphia, Pa., for the past fifteen years. He lives at 100 East Plumstead Avenue, Landsdowne, Pa.

'11, '13 ME—Howard A. Lincoln is with Bemis and Call Company, Springfield, Mass. He lives at 85 Western Drive, Longmeadow, Mass.

'12, '13 ME—Henry J. Helrfish is a development engineer with the Houde Engineering Corporation, Buffalo. He is a member of the Society of Automotive Engineers and is active in the Masonic order. His address is 105 Saranac Avenue, Buffalo.

One of the most interesting sets of photographs sent to the College of Engineering at Commencement for inclusion in the exhibit of work of engineering alumni came from David E. Lain '85, 4111 Linden Avenue, Seattle, Wash. One showed the motor of an electric locomotive, invented by his employer, Stephen D. Field, to replace steam locomotives on the Manhattan Elevated Railroad in New York and used to haul three-car trains in regular service in 1888.

"I had no assistance in the designing or figuring of this motor," says Mr. Lain, "which was made difficult by limitations of space and rate of armature revolution. The armature core was 22 inches in diameter, the largest then to be built." Although the electric locomotive was completely successful, a change in management of the railroad company prevented the electrification of the road until ten years later.

In the meantime Mr. Field and the firm of Oesterheld and Eickemeyer, who employed Mr. Lain, decided to build an electric locomotive suitable for street railways. Charles P. Steinmetz aided in making the drawings. The motor was the first of its kind to be geared to a truck.

A trolley car pulling a trailer was operated on the summer resort railroad on the north shore of Long Island in 1890. "I had charge," says Mr. Lain, "of equipping this road with the return-circuit trolley line. A large number of passengers were carried during that season without accident or injury of any kind.

"Mr. Eickemeyer and Mr. Field were so well pleased with the result that they took the contract to equip the Yonkers horse street railway with their electric motors. I was superintendent of this new trolley line for the first five months of its history. In addition to keeping the cars in operation, the horses and people on the streets must be made accustomed to the new horseless vehicles. Either job was no small task at that time. However, I resigned, because of broken health, on November 1st, 1892, with a record of no accidents due to road operations, and have not since that time actively engaged in engineering work."

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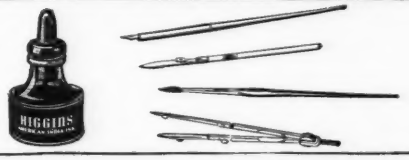

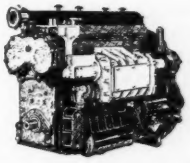

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GLASS BRICKS

(*Continued from page* 12)

The mortar used shall consist of one part waterproof Portland cement, one part lime, either hydrated or quick lime, and four parts sand, which shall be clean, sharp with angular particles, and free from vegetable matter, loam, and clay. Any standard brand of mortar may be used which has a compressive strength at the end of 28 days of 800 pounds per square inch. Horizontal mortar joints are to be reinforced with 20 guage expanded metal wall ties 2⅜ in. wide by 4 feet long. Ties are to run continually by lapping ends six inches. All panels are to be securely anchored to abutting materials. Expansion joints are to be provided when the panel is greater than 20 feet in either dimension. The top and sides of each panel should be protected with a cushioning material such as a mastic calking compound or asphalt paint. This cushioning material prevents the transmission of unequal strains or vibrations to the glass panel from the building. The panel must not be required to support the weight of the structure above. The structure surrounding a panel must be so designed as not to deflect or cause point loadings on the units.

Glass bricks have been used extensively in bands or panels in walls of industrial buildings, department stores, office buildings, apartment houses, hotels, schools, hospitals, food plants, and service stations. In most of these buildings they have been used in exterior walls in place of windows. They are also used in corridor walls where borrowed light and sound insulating properties are desirable. Glass blocks have another use in replacement panels in the modernization of old buildings and the installation of air conditioning equipment. For their decorative value they are used on store fronts, and on store front bulkheads for cellar illumination. With floodlight various decorative effects can be worked out. Glass blocks are used extensively for interior decoration work in restaurants, bars, cafeterias, and display rooms. With the change toward modernistic architecture in residences, their use has increased. Glass brick panels are used especially when it is desired to have day light but to obscure the vision.

The values for glass blocks in transmission of light, diffusion of light, resistance to sound transmission, structural strength, etc., were obtained from the results of tests made on blocks manufactured by two of the largest manufacturers of glass blocks, and therefore as changes are made in the character of glass blocks manufactured, these values may be expected to vary slightly.

Glass blocks have found a firm position in modern architecture because of their decorative value and their peculiar adaptability to many varied conditions.

ALUMNI NEWS

(*Continued from page* 24)

BIOGRAPHY

An oil portrait of Rolla C. Carpenter, late professor of Experimental Engineering in Cornell University, has been presented to the College of Engineering by the Cornell Society of Engineers. Painted by Professor Olaf Brauner of the College of Architecture, it will be added to the group of portraits of distinguished members of the faculty to be placed on permanent display in Sibley Dome.

Joining the Cornell faculty in 1890, Professor Carpenter was one of the men who made Cornell at the turn of the century the acknowledged leader in engineering education. **Experimental Engineering,** which he published the year he came to Cornell, was the first great laboratory manual in this field and profoundly influenced the practice of technical schools throughout the world. He was a prolific inventor of laboratory apparatus for special purposes, such as measuring the moisture content of steam and determining the heat value of fuels, and also won distinction as a consulting engineer, directing important projects for New York City, the City of Baltimore, and numerous private companies.

During his years at Cornell, 1890-1917, he served terms as president of the American Society of Heating and Ventilating Engineers, vice president of the American Society of Mechanical Engineers, and vice president of the American Society of Automobile Engineers, besides holding memberships in several other professional and honorary engineering societies. His publications included **Heating and Ventilating, 1898, Internal Combustion Engines** (with H. Diederichs), **1908,** and many articles in encyclopedias and scientific journals.

Born in Orion, Mich., in 1852, Professor Carpenter took B.S. and M.S. degrees at Michigan Agricultural College, the C.E. degree at the University of Michigan, and the M.M.E. degree at Cornell. Michigan Agricultural College later awarded him the honorary LLD. He was a member of the faculty of Michigan Agricultural College for 15 years before coming to Cornell as associate professor in 1890. He was made professor of experimental engineering in 1895, and held the title until his retirement in 1917.

●

Word has just reached Ithaca that Dr. C. F. Hirshfeld, Chief of Research of the Detroit Edison Company and past chairman and member of the Engineers' Council for Professional Development, was granted the honorary degree of Doctor of Engineering by the University of Detroit in the commencement exercises held on Tuesday, June 7, 1938. Dr. Hirshfeld graduated from Cornell University in Mechanical Engineering with the class of 1903. From 1904 to 1916 he was a member of the Faculty of the College of Engineering.

This distinction was awarded not only in recognition of Dr. Hirshfeld's technical and scientific accomplishments in the field of engineering, but more particularly because of the important part he has played in the movement to develop broad and cultivated gentlemen and citizens in the engineering profession as well as technically competent experts and specialists, and in recognition of the success of this movement as evidenced by the results gained by the Engineers' Council for Professional Development.

OFFICIAL PHOTOGRAPHER
1939 Cornellian

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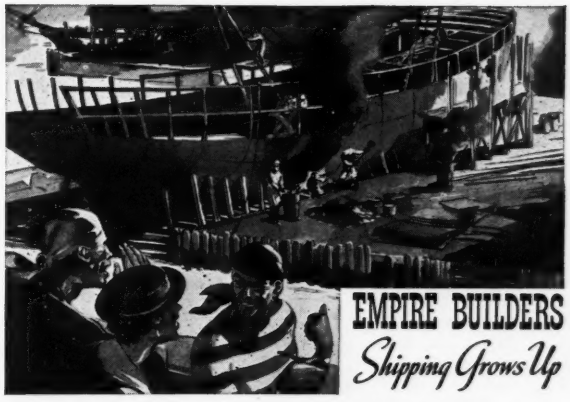

EMPIRE BUILDERS
Shipping Grows Up

In the 1878 issue of Lloyds' Register of British and Foreign Shipping, the screw steamer "Annie" was classed as *steel*—the first ship to be so rated. Shipping had grown up—within the span of a single generation, ships of *steel* supplanted vessels of wood and iron in carrying the cargoes of the world. In this swift development, R B & W—already backed with 33 years of experience—played an important part by furnishing EMPIRE Brand Bolts, Nuts and Rivets for the assembly of hulls, machinery and equipment necessary for propulsion and navigation.

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2. Sirs: I am forwarding my marriage certificate and 6 children. I had seven but one died, which was baptized on a half a sheet of paper by Rev. Thomas.

3. I am glad to say that my husband reported missing is now dead.

4. This is my eighth child, what are you going to do about it?

5. In answer to your letter, I have given birth to a boy weighing 10 lbs. I hope this is satisfactory.

6. I am very much annoyed to find that you have branded my boy as illiterite, this is a dirty lie, as I was married to his father a week before he was born.

7. I am forwarding my two children and my marriage certificate one of which is a mistake, as you will see.

8. I cannot get sick pay. Can you tell me why? In accordance with your instructions I have given birth to twins in the enclosed envelope.

●

The helpful old gentlemen saw a small boy trying to reach a door bell, he walked up and rang it for the little fellow and then turned to him and said—"What are you going to do now my little man?" "You'd better run," the boy replied, "that's what I'm going to do."

●

Overheard at a fraternity banquet—Here's to the land we love and vice-versa.

●

Engineering lecturer: "I hope I haven't talked too long, but I haven't a watch and I can't see any clock."

Student: "Why don't you look at the calendar on the wall?"

●

Voice in B.I.M. class: "Give me liberty or give me death."

Prof. Bangs: "Who said that?"

VIBIMC: "Patrick Henry!"

●

A man was carrying a grandfather's clock down the street. He was met by a slightly inebriated gentleman. The drunk stopped, stared and then said: "Say buddy, why doncha carry a wrist watch?"

●

"How's business?" a passerby asked the scissors grinder.

"Fine," he replied, "I've never seen things so dull."

THE TWENTY-THIRD PSALM OF AN ENGINEER'S SWEETHEART

"Verily, I say unto you, marry not an engineer, for an engineer is a strange being and is possessed of many evils. Yea, he speaketh eternally in parables which he calleth formulae . . . He showeth always a serious aspect and seemeth not to know how to smile, and he picketh a seat in a car by the springs therein and not by the damsels. Verily, though his damsel expecteth chocolates when he calleth, she openeth the package to disclose samples of iron ore. Yea, he holdeth her hand but to measure the friction therein. And he kisseth her only to test the viscosity of her lips. For in his eyes there shineth a faraway look that is neither love nor longing—rather a vain attempt to recall a formula . . . Even as a boy he pulleth a girl's hair but to test its elasticity. But as a man he discovereth different devices; for he counteth the vibrations of her heart strings . . . His marriage will be a simultaneous equation involving two unknowns yielding diverse results . . . —*The Kansas Engineer*

●

Definition: Research—a blind man in a dark room, hunting for a black cat that isn't there.

—*The Illinois Technograph*

●

The police have a theory regarding the gangster who was captured with one large and three small revolvers concealed on his person; the gat had gittens.

●

A young man by the name of C. H. Fore was recently arrested on a charge of intoxication. Of course any chemistry student will recognize C. H. as one of the saturated series.

●

An arts student is a fellow who doesn't know whether to sleep in the morning, or get up so he'll have a longer day to loaf.

●

The R.O.T.C.
May be a good thing;
We learn marching, shooting,
And skirmishing.
Statistics, ballistics,
First-aid, parade,
A wealth of things
And yet I'm afraid;
In the frenzy of war
There's more to be said,
For a two-year course
In dodging lead. —*Purdue Engineer*

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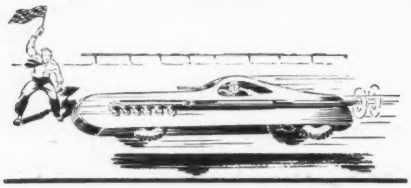
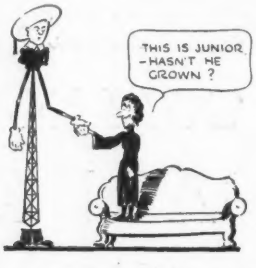


"SPEED DEMON"

HAIL the new speed champion—a champion who has never seen a speedway or flown an airplane. The Olympics mean nothing to him.

"He" is a tiny quartz crystal that has set a new record by vibrating at a pace that puts the hard-working human heart to shame—20,000,000 vibrations a second, or 16,666,666 times faster than the normal human heartbeat.

This speed demon is used in a new oscillator developed by General Electric engineers for maintaining constant frequencies in radio transmitting. Careful mechanical grinding and painstaking polishing by hand reduce the rough crystals to the size required for the particular broadcasting frequency used. Then the simple instrument is installed in the transmitter circuit and goes to work making the station stay on its assigned wave length.



THE BABY GROWS UP

SIXTEEN years ago G-E radio engineers crossed their fingers and snapped a switch in one of the laboratories at Schenectady—and a split second later heard through clumsy earphones, "This is WGY, radio broadcasting station of the General Electric Company, Schenectady, New York."

That was the "birth announcement" for this G-E station, whose rise from swaddling clothes to the lusty strength of sixteen years has paralleled the rise of radio broadcasting from experiment to smooth efficiency.

From the start, WGY was an unusual child. When only three days old, it started pioneering by presenting the first remote-control broadcast. And the pioneering is still going strong. As the station grew, it provided the groundwork for network broadcasting, mobile transmission, coast-to-coast television broadcasts.

This year, WGY celebrates its sixteenth birthday with a new 625-foot nondirectional antenna (70 feet higher than Washington Monument) and a modernistic new studio building with everything from a model kitchen to a large audience studio.

Engineers conduct tests on the young giant day and night. Some are the veterans who started years ago—others are recent graduates of engineering schools assigned to the control rooms and transmitters upon completion of their G-E training courses. Results of the tests these two groups conduct today will appear as refinements in the broadcasting of tomorrow.

ELECTRICAL TROUBLE SHOOTER

TWO men are carefully examining a large x-ray photograph in a darkened room. One of them points to some dark spots, some wavy lines. . . . "There's the trouble."

This might well be taking place in a large medical laboratory. Instead, factory production lines and machinery are only a few feet away—it is a testing room in which x-ray photographs of steel castings are examined. In many such rooms, in all parts of the country, other engineers are making like tests—tests that ferret out defects in castings before they can cause trouble.

Knowing in detail the symptoms of every defect, these engineers, guided by the x-ray, detect gas pockets, shrinkage areas, and internal cracks. They eliminate all but "smooth" castings.

Such applications, of which many persons are not aware, are typical results of the constant search by G-E engineers for new uses of the x-ray. And not all of these engineers are veterans—some only a few years ago completed their studies in engineering schools and came on Test with General Electric.

GENERAL ELECTRIC

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